

Gas Leak on Converter 2nd Pass Outlet

$P/P_A = 1.356$ ^{missing} less than 1.893 $[(k + 1) / 2]^{k / (k - 1)}$ therefore the flow is non-choked (i.e. subsonic), AND the following equation applies

$$Q = CAP \sqrt{(2g_c / ZRT)(K/K-1)[(P_A/P)^{2/K} - (P_A/P)^{(K+1)/K}]}$$

				psia	psig	in WC
Q = mass gas flow (lbs/s)		K = C_p/C_v of the gas	1.4			
C = discharge coefficient	0.65	P = source pressure absolute (lb/ft ²)	2871	19.9	5.2	145
Equivalent Diameter of hole (in)	0.77	P _A = ambient pressure absolute (lb/ft ²)	2117	14.7		
A = area of hole (ft ²)	0.00323	M = molecular weight of gas	34			
g _c = gravitational constant (ft/s)	32.17	Z = compressibility factor	1.077063			
R = gas constant (ft-lb/lb mol - °R)	1543.3	Release duration (seconds)	35,496			
T = temperature (°R)	1410	SO ₃ concentration in gas (wt%)	22.4			
	510 °C	SO ₂ concentration in gas (wt%)	2.0			
Molecular weight of SO ₃	80	Molecular weight of SO ₂	64			

Intermediate Calculations:

0.000934

3.5

0.647034

0.593079

6.031606

Mass Calculations:

Q = 0.0801 lbs/s

Total mass: 2843 lbs

Total SO₃ mass: 318 lbs

Total SO₂ mass: 28 lbs

Note: SO₃ immediately reacts with H₂O to form acid mist; RQ for acid mist = 1,000 lbs

Reference: "Perry's Chemical Engineering Handbook, 6th Edition, McGraw-Hill 1984"

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